Dominion Nuclear Connecticut, Inc.
Millstone Power Station
Rope Ferry Road
Waterford, CT 06385

Dominion

NOV 10 2003

Docket No. 50-423
B19018

RE: 10 CFR 50.12
10 CFR 50.44
10 CFR 50.46
10 CFR 50 Appendix K

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Millstone Power Station, Unit No. 3
Response to Request for Additional Information Regarding Exemption to Use a Low Tin Cladding (TAC No. MB9897)

By a letter dated July 1, 2003,[1] Dominion Nuclear Connecticut, Inc. (DNC) requested an exemption from certain requirements of 10 CFR 50.44, "Standards for Combustible Gas Control System in Light-Water-Cooled Power Reactors," 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors," and Appendix K of 10 CFR 50, "ECCS Evaluation Models." The exemption requested relates solely to the specific types of cladding material specified in these regulations for use in light water reactors. As written, the regulations presume the use of Zircaloy or ZIRLO™ fuel rod cladding. In order to use Optimized ZIRLO™, a limited exemption to these regulations is needed. DNC requested an exemption of these requirements to allow up to eight lead test assemblies (LTAs) containing fuel rods, guide thimble tubes, and instrumentation tubes fabricated with a "low tin" version of ZIRLO™ (Optimized ZIRLO™).

By a letter dated September 26, 2003,[2] the Nuclear Regulatory Commission (NRC) requested additional information (RAI) in order to continue review of the DNC exemption request. A conference call was held on November 6, 2003 between

[1] J. A. Price letter to the U.S. NRC, "Millstone Power Station, Unit No. 3, Request for Exemption Pursuant to 10 CFR 50.12 - Exemption to the Cladding Material Specified in 10 CFR 50.44, 10 CFR 50.46, and 10 CFR 50 Appendix K," dated July 1, 2003.

[2] U.S. NRC letter to D. A. Christian, "Millstone Power Station, Unit No. 3, Request for Additional Information Regarding Exemption to Use a Low Tin Cladding (TAC No. MB9897)," dated September 26, 2003.

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representatives of DNC and the NRC staff. The purpose of the call was to ensure a common understanding of the information requested.

Attachment 1 provides the DNC response to the September 26, 2003, RAI.

There are no regulatory commitments contained in this letter.

If you should have any questions on the above, please contact Mr. David Dodson at (860) 440-2346.

Very truly yours,

DOMINION NUCLEAR CONNECTICUT, INC.

J. Alan Price
Site Vice President - Millstone

Attachments: (1)

cc:
H. J. Miller, Region I Administrator
V. Nerses, NRC Senior Project Manager, Millstone Unit No. 3
Millstone Senior Resident Inspector

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Attachment 1

Millstone Power Station, Unit No. 3

Response to Request for Additional Information Regarding Exemption to Use a Low Tin Cladding (TAC No. MB9897)

Millstone Power Station, Unit No. 3
Response to Request for Additional Information Regarding Exemption to Use a Low Tin Cladding (TAC NO. MB9897)

By letter dated July 1, 2003, Dominion Nuclear Connecticut (DNC), Inc., requested an exemption from the requirements of Title 10 of the Code of Federal Regulations (10 CFR) Parts 50.44, 50.46, and Appendix K. The purpose of this exemption would allow the use of up to eight lead test assemblies fabricated with a "low tin" version of ZIRLO™. The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the information the licensee provided that supports the proposed changes to the Technical Specification (TS). In order for the staff to complete its evaluation, the following additional information is requested:

Question 1: Attachment 1, Page 1, of the DNC letter dated July 1, 2003, states, "Westinghouse has submitted Addendum 1 to WCAP-12610-P-A/CENPD-404-P-A that addresses Optimized ZIRLO™ and demonstrates that Optimized ZIRLO™ has essentially the same properties as currently licensed ZIRLO™ and fits the definition of ZIRLO™ that was used when the "Rule" change was made to 10 CFR 50.44 and 10 CFR 50.46." Review of Addendum 1 is currently underway and this conclusion has not been acknowledged by the staff. Review of this exemption request needs to remain independent of Addendum 1 to WCAP-12610-P-A/CENPD-404-P-A. Instead of referencing Addendum 1, provide all necessary supporting material.

Response 1: DNC understands that the staff is currently reviewing Addendum 1 to WCAP-12610-P-A/CENPD-404-P-A and that this review is not yet complete. It was not our intent to link the approval of this exemption request to that addendum. This response serves to clarify that for this lead test assembly (LTA) program we are treating Optimized ZIRLO™ as a separate cladding material from standard ZIRLO™, and are therefore requesting this exemption. The original request was intended to contain the same information as other previously approved exemption requests by Exelon Corporation and Duke Power Corporation for "low tin" ZIRLO™, with the exception of mentioning the submittal of Addendum 1 to WCAP-12610-P-A. (References 2 and 3 of the DNC letter of July 1, 2003.) The mention of the topical report addendum was to note that substantial testing and confirmation of the new cladding by Westinghouse has been completed. Based on the discussion during the November 6, 2003 conference call, we understand that the staff requires no further information on this matter.

Question 2: TS 5.3.1 states, "A limited number of lead test assemblies that have not completed representative testing may be placed in non-limiting core regions." The exemption request states that the reload design will ensure that the lead test assemblies (LTAs) are not placed in limiting core

locations. Describe the fuel management guidelines and supporting safety analyses used to ensure that the LTAs are not placed in limiting locations.

Response 2: Non-limiting core regions are those core locations where the LTA will operate with more margin to thermal limits than the lead non-LTA assembly under all normal operating conditions. The Millstone Unit No. 3 Cycle 10 loading pattern was developed with the LTAs being placed in core feed locations where the peaking factors were projected to be approximately 5% below the lead assembly in the core. By maintaining approximately 5% margin below the lead assembly, it has been shown that the LTAs will not be limiting from a LOCA peaking factor limit or DNB design criteria under normal operating conditions.

Question 3: The exemption request does not specify fuel duty targets for the eight LTAs.

(a) Provide fuel duty targets for the eight LTAs, including projected burnup for each reload cycle.

(b) Is projected burnup expected to exceed the current licensed limit for ZIRLO™?

(c) Is projected fuel duty expected to exceed limits of less than 100 microns of predicted oxidation with no blistering or spallation?

Response 3: (a) The Millstone Unit No. 3 LTA program was not designed to achieve any specific fuel duty target. The current projected lead rod burnup for these assemblies, at the end of the first cycle, will be < 30,000 MWD/MTU, based on a Cycle 9 shutdown burnup of 20,800 MWD/MTU and a Cycle 10 shutdown burnup of 21,300 MWD/MTU. Loading plans beyond the first cycle of LTA operation have not been finalized. Since the LTAs will be operated approximately 5% below the lead fuel assembly, the fuel duty index for the LTAs will be well within the operating experience base.

(b) The projected burnup will not exceed the current licensed ZIRLO™ limit. The LTAs have not yet been considered for a high burnup program.

(c) The 100 micron best estimate oxidation value is an internal Westinghouse limit which will not be exceeded with the Millstone Unit No. 3 projected fuel duty estimate.

Question 4: The exemption request does not specify post-irradiation examinations for the eight LTAs. Provide the details of the examinations (e.g., visual, fuel assembly length, fuel assembly bow, fuel assembly drag, fuel rod length, fuel rod wear, fuel rod profilometry, cladding oxidation, etc.) planned for the LTAs.

Response 4: At the end of each of the three LTA irradiation cycles, various on-site non-destructive post-irradiation examinations (PIE) will be performed on selected LTAs. A listing of the intended inspections to be performed is provided below. The initial inspection schedule agreed upon by Westinghouse and DNC is as follows.

At the end of the first LTA operating cycle (Cycle 10, circa October 2005), no LTAs will be permanently discharged from the core. Visual inspections on two LTAs and one Robust Fuel Assembly (RFA) are to be performed in the spent fuel pool during the outage.

At the end of the second LTA operating cycle (Cycle 11), a group of the LTAs will be discharged from the core. The number of LTAs to be reinserted will be based on the design constraints of the Cycle 12 loading plan. There will be a visual inspection during the outage on two of the reinsert LTAs. The other examinations, described below, are to be performed in the spent fuel pool during the subsequent operating cycle (Cycle 12).

At the end of the third LTA operating cycle (Cycle 12), the remaining in-core LTAs are to be discharged from the core. PIE are to be performed on four of these discharged LTAs during the subsequent cycle.

LTA Post-Irradiation Examinations

Fuel Assembly Visual: All four faces of the LTAs will be visually examined from the top to the bottom to confirm the mechanical integrity of the assembly.

Fuel Rod Removal: The removed rods are examined / inspected in rack-level equipment and undergo fuel rod visual examination, rod profilometry, and rod oxide thickness measurement.

Cell Size Measurements: This inspection measures the grid cell size of each grid in the assembly.

Fuel Rod Visual: This visual examination is to confirm the mechanical integrity of the fuel rod.

Fuel Rod Wear Measurements: Fuel rod wear will be quantified to determine the loss of cross-sectional area at each wear site over the length of the rod.

Rod Profilometry: This examination obtains the rod diameter change due to cladding Creep. The data is used to evaluate the rod retention force.

Assembly Length: This examination provides the assembly growth data.

Assembly Bow: This inspection provides the change in assembly straightness.

Rod-to-Nozzle Gap: This inspection provides rod growth data.

Rod Cluster Control Assembly Drag Test: This inspection provides the extent of thimble tube straightness.

Grid Width Measurements: The distance between the two spring slots on the outer strap is measured on selected grids to determine the grid width change from the non-irradiated nominal dimension.

Fuel Rod Oxide Thickness Measurements: Fuel rod oxide is one of the most important parameters for high burnups. Because the rod oxide increases as the burnup increases, it is important to measure the rod oxide on the fuel rod surface after the second and third cycles of irradiation to confirm the fuel has enough corrosion margin.

Grid Oxide Thickness Measurements: Oxide thickness is measured on the outer grid straps of one face from each of the selected grids in a manner similar to that used for fuel rod oxide measurements.

Question 5: How will DNC/Westinghouse ensure that fuel performance models and fuel duty predictions remain conservative for this developmental cladding material, especially in subsequent cycles?

Response 5: The change in the specification of the ZIRLO™ content is expected to enhance the performance of the cladding. The expected performance of the Optimized ZIRLO™ for material properties, corrosion, and thermal creep is described in the original exemption request. No credit for any improved performance will be assumed in fuel performance evaluations of the LTAs. The Byron Station LTA program has confirmed the expected performance of "low tin" ZIRLO™ and the acceptability of the Westinghouse fuel performance models. In addition, the end of cycle post-irradiation examinations for the Millstone Unit No. 3 LTA program and other LTA programs will be used to validate the acceptability of the fuel performance models. The PIE measurements will be compared to the model predictions. Significant deviations from these predictions will be addressed and reconciled in the fuel performance models.

Question 6: Attachment 1, Page 7, of DNC letter dated July 1, 2003, states, "Application of the Baker-Just equation has been demonstrated to be appropriate for the Optimized ZIRLO™ alloy. Due to the similarities in the composition of the Optimized ZIRLO™ and standard ZIRLO™, the application of the Baker-Just equation will continue to conservatively

bound all post-loss-of-coolant accident scenarios."

(a) In the first sentence, did you mean to state that the Baker-Just equation has been demonstrated to be appropriate for standard ZIRLO™?

(b) If it is correctly written, where has the Baker-Just equation been previously demonstrated to be appropriate for Optimized ZIRLO™?

Response 6: The statement that the Baker-Just equation has been demonstrated to be appropriate for Optimized ZIRLO™ was correctly written. Given the minor differences between Optimized and standard ZIRLO™, the bounding nature of the Baker-Just equation was expected to be preserved. However, Westinghouse did conduct testing to confirm the conservatism of the Baker-Just equation. Please refer to the second paragraph under "Special Circumstances Support the Issuance of an Exemption" on page 6 of Attachment 1 to the DNC exemption request for Millstone Unit No. 3. Note that this testing is also documented in Addendum 1 of topical report WCAP-12610-P-A / CENPD-404-P-A.